Perspectives on Operational Requirements and Vulnerability Reduction

ADPA Symposium, Naval Postgraduate School
October 21, 1997

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With Apologies to the Schoolhouse.....

- **Susceptibility is an operational construct**
  Vulnerability is a design and programmatic construct

Fiscal Realities

- **In programmatic, material terms, Vulnerability reduction is a function of design and retrofit dollars available**

Backdrop Assumptions

- **The Marine Corps Aviation Combat Element (ACE) of the near term will be characterized by a "mature" assault support fleet of legacy aircraft that will still be operating 2010-2020**

Backdrop Assumptions

- **Threat proliferation trends will continue, with anti-aircraft weaponry expanding throughout the littoral battlespace**
- **Any weapon, anti-air or not, can kill USMC aircraft, given the right conditions**
  - **Waterfowl have at least 7 recorded kills**

Backdrop Assumptions

- **The past, current, and future threats are ones which capitalize on some of our historical vulnerabilities:**
  - **IR hotspots**
  - **Aircrew safety**
  - **Intelligence gaps**

    Cultural Character (TRAP, NEO, etc)

Operational Realities

- **The pace of technological change has far exceeded that of vulnerability reduction**
  - **The MV-22 of 2020 will continue to be vulnerable in some of the same ways as the CH-46 of 1965**

Operational Realities (cont'd)

- **Predicted operational tempos do not offer any relief from being exposed to increasing numbers of threats, especially in the urban environment**

- **For our present aircraft, vulnerability quotients will outpace reduction efforts as weapons become both more prevalent and accurate**

Operational Perspective

- **Those factors which highlight present aircraft vulnerability are largely immutable:**
  - **Cannot select operating environment**
  - **Cannot preclude all weapon engagements**
  - **Cannot protect against every weapon**

  Multi-mission optimization has its costs...

Design and Programmatics

- **From the aspect of aircraft design and program management, actions which effect fleet aircraft vulnerability are addressable from this point forward.**
  - **Retrofit is not a salable option**

Present Efforts

- **F/A-18 C/D Hornet**
  - Fuel System
    - Fuel isolation from engines
    - Fuel tank hydraulic ram
    - Self-sealing feed tanks and engine feed lines
    - Void filler foam for dry by fire protection below fuselage tanks
    - Wing tank unexpended fuel explosion protection
  - Flight Control System
    - Redundant separated hydraulics
    - Rip stop actuators, Hydraulic reservoir level sensing
    - Redundant flight control conputers
    - Mechanical backup
  - Propulsion System
    - Fire detection and extinguishing system
    - Blade containment measures
- **No improvements planned**

Present Efforts (cont'd)

- AV-8B (Day and Reman A/C)
  - No improvements planned
- EA-6B
  - Blk 89A Halon fire extinguisher
- KC-130F/R/T
  - No improvements planned

Present Efforts (cont'd)

- **CH-46**
  - Self-sealing fuel tanks
- **No improvements planned**
- **CH-53D/E**
  - Self-sealing fuel tanks
- **No improvements planned**
- **UH-1N/4BN//AH-1W/4BW**

  No improvements planned

Future Efforts

- **MV-22**
  - Systems Protection
    - Armor
    - System Isolation
    - System Redundancy
    - System Separation
  - Ballistic tolerance
    - Engine Fire Suppression
    - Nitrogen Inerted Fuel Tanks
    - Self-sealing Fuel Bladders
    - Hydraulic Ram Protection
    - Dry Bay Fire Protection
    - Composite Structure
    - Capability vs. 23mm API (threshold = 12.7 mm)

Future Efforts (cont'd)

- **KC-130J**
  - **Reticulated Wing Tank Foam**
    - Approximately 80% improvement in vulnerability reduction
  - **Data bus wiring**
    - Reduces wiring bundling throughout aircraft

Conclusion

- **Future design goals make appropriate and overdue reductions in aircraft vulnerabilities**
- **Current aircraft will continue to present challenges for vulnerability reduction efforts**

Backup slides
follow.....

The Reality of USMC Operations

- **Operational Maneuver from the Sea**
- **USMC must be "Ready on Arrival"**
- **The Battlespace may be Immature**
- **Close proximity to the threat**
- **Threats cover all spectra (RF, IR, Visual, Acoustic)**

USMC Operations — Expeditionary

Immature Battlefield

- **Intelligence capabilities not fully deployed**
- **Dominant battlefield knowledge not fully developed**

Come as you are, Fight as you train

Expeditionary Operations

- **Aircraft**
  - **Maintainable**
  - **Repairable**
  - **Small logistical tail**
  - **High sortie rate**
    - **minimum maintenance**
  - **Multi mission profile**

- **Mission**
  - **Dynamic, fluid threat**
  - **Proximity to threat**
    - **Min. reaction time**
    - **Low J/S strength**
    - **EOB inaccuracies**
    - **Exposure time**
  - **24 hour operations**
  - **All spectrum threats**

The Future

-
- Fixed Wing Attk AV-8B+F-18C/D = JSF
- Support EA-6B+C-130 = EA + C-
- 130J
- Rotary Wing Lift CH-46+CH-53 = V-22
- Rotary Wing Attk UH-1N+AH-1W = 4BN + 4BW =
- JRA

Force Mix Challenges Technology

Factors Affecting Investment Strategy

- **Lack of independent resources**
- **Unique requirements**
- **Small force**

Major Investments made by others